Computerized Manufacturing and Machining Technology

Program of Studies

2014-2015

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Manufacturing Programs
Office of Career and Technical Education
Kentucky Department of Education

Computerized Manufacturing and Machining Technology

Program Area Course Title	Post-Secondary Connection	Valid Course Code	Recommended Grade Level							Recommended Credit
			6	7	8	9	10	11	12	
Advanced CAD	**CAD 250**	**480114**						X	X	1
Advanced Dimensioning and Measurement	**CAD 240**	**470924**						X	X	1
Applied Machining - I	**CMM 120**	**470911**					X	X	X	1
Applied Machining - II	**CMM 122**	**470912**						X	X	1
Basic Blueprint Reading for Machinist	**BRX 110**	**470920**				X	X	X	X	**.5**
Blueprint Reading for Machinists	**BRX 112**	**470921**				X	X	X	X	**1**
CAD/CAM/CNC	**CMM 132**	**470925**						X	X	**1**
Cooperative Education I	**CMM 199**	**470929**							X	1
Cooperative Education II	**CMM 299**	**470930**							X	**2**
Cooperative Education III	**CMM 199 & 299**	**470931**							X	**3**
Digital Literacy	**DLC 100**	**480101**			X	X	X			**.5**
Editing and Subroutines (Conversational)	**CMM 2302**	**470927**						X	X	**1**
Fundamentals of Machine Tools - A	**CMM 110**	**470913**					X	X		1
Fundamentals of Machine Tools - B	**CMM 112**	**470914**					X	X	X	1
Internship (Machine Tool)	**CMM 198**	**470932**						X	X	**1-3**
Intermediate Computer Aided Drafting	**CAD 200**	**480112**					X	X	X	1
Introduction to Computer Aided Drafting	**CAD 100**	**480110**				X	X	X	X	**1**
Introduction to Conversational Programming	**CMM 2301**	**470926**						X	X	**1**
Manual Programming	**CMM 130**	**470915**						X	X	1
Mechanical Blueprint Reading	**BRX 210**	**470922**						X	X	**.5**
Metrology/Control Charts	**CMM 118**	**470928**						X	X	**.5**
Special Problems	**IEX 293**	**470979**							X	**1**
***Technical Mathematics**	**MAT 116**	**270643**						X	X	**1**

***Must be taught for Dual credit.**

Computerized Manufacturing and Machining Technology

Overview of Computerized Manufacturing and Machining Technology

Purpose:

The vision of Computerized Manufacturing and Machining Technology is to promote safety standards, performance standards, enhance leadership, provide relevant curriculum, and to be vital to the education of all students.

The Computerized Manufacturing and Machining Technology Program prepare students by engaging them with science, mathematical, and critical thinking skills through the classroom and lab/shop training.

Computerized Manufacturing and Machining Technology will:

- Operate as the venue for nationally recognized industry standard training.
- Provide a critical link in school to employment or postsecondary education.
- Develop stronger relationships with the community in terms of mutual advocacy, cooperative field experiences, employment placement, and support for relevant student organizations and competitions
- Represent an important component in the education of all students.
- Require and promote critical thinking and problem solving.
- Offer an up to date curriculum based on standards that adapts to changes in the industry.
- Integrate academic skills into the Computerized Manufacturing and Machining Technology Curriculum in order to insure that students develop written & verbal communications skills, computational skills, and scientific/math problem-solving skills.

Career Pathways:

- ***Machinist Assistant***
- ***Machine Operator***
- ***CNC Programmer Assistant***
- ***CNC Machine Operator***
- ***CAD/CAM Operator***

Standard Based Curriculum

The Computerized Manufacturing and Machining Technology Curriculum is composed of standards based competencies. All Computerized Manufacturing and Machining Technology programs incorporate industry and common core standards thus increasing the student's qualifications toward successful employment.

Alignment of the Computerized Manufacturing and Machining Technology curriculum with nationally recognized industry standards and the common core standards provides optimal preparation for students to acquire an industry certification.

Communities understand that this preparation provides better career opportunities for students and the demands of today's workforce for the 21st century.

Kentucky Occupational Skill Standards
The Kentucky Occupational Skill Standards are the performance specifications that identify the knowledge, skills, and abilities an individual needs to succeed in the workplace. Identifying the necessary skills is critical to preparing students for entry into employment or postsecondary education. These standards described the necessary **occupational, academic,** and **employability** skills needed to enter the workforce or post- secondary education in specific career areas. There is an ongoing effort to continue to refine these standards by which exemplary Career and Technical Education Programs are evaluated and certified. This helps insure that curriculum meets industry specifications.

Work Based Learning
Cooperative experience, internships, shadowing and mentoring opportunities provide depth and breadth of learning in the instructional program and allow students to apply the concepts learned in the classroom. The Work Base Learning Guide is available on the KDE webpage: www.education.ky.gov.

Student Organizations and Competitions
Participation in Skills USA Competition provides a vehicle for students to employ higher order thinking skills, to interact with high-level industry people and to further enhance their leadership skill through their participation in regional, state and national competitive events and local activities.

KDE/OCTE Career Pathways Computerized Manufacturing and Machining Technology 2014-2015		
Career Pathway	**Core Courses**	**Elective Courses**
• ***Machinist Technician*** **CIP Code-48.0503.01** ***Tests for Certification*** **MasterCam** **(NIMS) National Institute for Metalworking Skills** **SolidWorks (CSWA)** **TRACK Pre-Apprenticeship** **KOSSA-Manufacturing Test**	• **BRX 112 Blueprint Reading for Machinists-470921** • **CMM 110 Fundamentals of Machine Tools-A - 470913** • **CMM 112 Fundamentals of Machine Tools-B-470914** • **CMM 120 Applied Machining - I - 470911**	• **CMM 122 Applied Machining - II - 470912** • **CMM 199 Cooperative Education I -470929** • **CMM 299 Cooperative Education II -470930** • **CMM 199 & 299 Cooperative Education III -470931** • **CMM 198 Internship I-470932** • **IEX 293 Special Problems-470979** • **CMM 130 Manual Programming-470915** • **CAD 200 Intermediate Computer Aided Drafting-480112** • **CAD 100 Introduction to Computer Aided Drafting-480110** • **BRX 210 Mechanical Blueprint Reading-470922** • **CMM 118 Metrology-470928** • **Technical Mathematics-270643** • **PLTW IED-Introduction to Engineering Design-219901** • **Other courses approved by Program Area Consultant**
• ***Machine Operator*** **CIP Code-48.0503.02** ***Tests for Certification*** **MasterCam** **(NIMS) National Institute for Metalworking Skills** **SolidWorks (CSWA)** **TRACK Pre-Apprenticeship** **KOSSA-Manufacturing Test**	• **CMM 110 Fundamentals of Machine Tools-A - 470913** • **CMM 112 Fundamentals of Machine Tools-B-470914** • **CMM 120 Applied Machining - I - 470911** • **CMM 122 Applied Machining - II - 470912**	• **BRX 110 Basic Blueprint Reading for Machinist-470920** • **BRX 112 Blueprint Reading for Machinists-470921** • **BRX 210 Mechanical Blueprint Reading-470922** • **CMM 130 Manual Programming-470915** • **CMM 199 Cooperative Education I -470929** • **CMM 299 Cooperative Education II -470930** • **Cooperative Education III - 470931** • **CAD 100 Introduction to Computer Aided Drafting-480110** • **CAD 200 Intermediate Computer Aided Drafting-480112** • **CMM 198 Internship I-**

		470932 • **IEX 293 Special Problems-470979** • **MAT 116 Technical Mathematics-270643** • **PLTW IED-Introduction to Engineering Design-219901** • **Other courses approved by Program Area Consultant**
CNC Programmer **CIP Code-48.0503.03** ***Tests for Certification*** **MasterCam** **(NIMS) National Institute for Metalworking Skills** **SolidWorks (CSWA)** **TRACK Pre-Apprenticeship** **KOSSA-Manufacturing Test**	• **BRX 112 Blueprint Reading for Machinists-470921** • **CAD 100- Introduction to Computer Aided Drafting-480110** • **CMM 110 Fundamentals of Machine Tools-A - 470913** • **CMM 130 Manual Programming-470915** • **CMM 132 CAD/CAM/CNC- 470925**	• **CAD 240 Advanced Dimensioning and Measurement-470924** • **CMM 199 Cooperative Education I -470929** • **CMM 299 Cooperative Education II -470930** • **CMM 199 & 299 Cooperative Education III -470931** • **Editing and Subroutines (Conversational)-470927** • **CAD 200 Intermediate Computer Aided Drafting-480112** • **CMM 198 Internship I-470932** • **Introduction to Conversational Programming-470926** • **IEX 293 Special Problems-470979** • **CMM 112 Fundamentals of Machine Tools-B- 470914** • **CMM 120 Applied Machining - I - 470911** • **BRX 210 Mechanical Blueprint Reading-470922** • **CMM 118 Metrology-470928** • **Technical Mathematics-270643** • **PLTW IED-Introduction to Engineering Design-219901** • **Other courses approved by Program Area Consultant**
• ***CNC Machine Operator*** **CIP Code-48.0503.04** ***Tests for Certification*** **MasterCam** **(NIMS) National Institute for**	• **CMM 110 Fundamentals of Machine Tools-A - 470913** • **CMM 112 Fundamentals of Machine Tools-B-470914** • **CMM 130 Manual Programming-470915**	• **CMM 120 Applied Machining - I - 470911** • **CMM 122 Applied Machining - II - 470912** • **BRX 110 Basic Blueprint Reading for Machinist-470920** • **BRX 112 Blueprint Reading for Machinists-470921** • **CAD 100- Introduction to Computer Aided Drafting-**

Metalworking Skills **SolidWorks (CSWA)** **TRACK Pre-Apprenticeship** **KOSSA-Manufacturing Test**	• **CMM 132 CAD/CAM/CNC- 470925**	**480110** • **CAD 200 Intermediate Computer Aided Drafting-480112** • **CMM 199 Cooperative Education I -470929** • **CMM 299 Cooperative Education II -470930** • **CMM 199 & 299 Cooperative Education III -470931** • **Editing and Subroutines (Conversational)-470927** • **CAD 100 Introduction to Computer Aided Drafting-480110** • **CAD 200 Intermediate Computer Aided Drafting-480112** • **CMM 198 Internship I-470932** • **Introduction to Conversational Programming-470926** • **BRX 210 Mechanical Blueprint Reading-470922** • **IEX 293 Special Problems-470979** • **CMM 118 Metrology-470928** • **Technical Mathematics-270643** • **PLTW IED-Introduction to Engineering Design-219901** • **Other courses approved by Program Area Consultant**
• ***CAD/CAM Operator*** **CIP Code-48.0503.05** ***Tests for Certification*** ***Tests for Certification*** **MasterCam** **(NIMS) National Institute for Metalworking Skills** **SolidWorks (CSWA)** **TRACK Pre-Apprenticeship**	• **CAD 100-Introduction to Computer Aided Drafting-480110** • **CMM 132 CAD/CAM/CNC-470925** • **CAD 200 Intermediate CAD-480110** • **CAD 250 Advanced CAD-480114**	• **BRX 110 Basic Blueprint Reading for Machinist-470920** • **BRX 112 Blueprint Reading for Machinists-470921** • **BRX 210 Mechanical Blueprint Reading-470922** • **CMM 199 Cooperative Education I -470929** • **CMM 299 Cooperative Education II -470930** • **CMM 199 & 299 Cooperative Education III -470931** • **Editing and Subroutines (Conversational)-470927** • **CAD 200 Intermediate Computer Aided**

KOSSA-Manufacturing Test		**Drafting-480112** • **CMM 198 Internship I-470932** • **Introduction to Conversational Programming-470926** • **IEX 293 Special Problems-470979** • **CMM 110 Fundamentals of Machine Tools-A - 470913** • **CMM 112 Fundamentals of Machine Tools-B-470914** • **CMM 118 Metrology-470928** • **CMM 120 Applied Machining - I - 470911** • **PLTW IED-Introduction to Engineering Design-219901** • **Other courses approved by Program Area Consultant**

• ***Computerized Manufacturing& Machining-TRACK*** **CIP Code-48.0503.99** ***Tests for Certification*** **MasterCam** **(NIMS) National Institute for Metalworking Skills** **SolidWorks (CSWA)** **TRACK Pre-Apprenticeship** **KOSSA-Manufacturing Test**	• **(4)- Core courses** • **Chosen from CMM valid course list.** • **By Company sponsoring State Registered Apprenticeship.**	• **(4)- Core courses** • **Chosen from CMM valid course list.** • **By Company sponsoring State Registered Apprenticeship.** •

KENTUCKY CAREER PATHWAY/PROGRAM OF STUDY TEMPLATE

COLLEGE/UNIVERSITY: Kentucky College/State University
CLUSTER: Manufacturing
PATHWAY: Machinist/Manufacturing Mgr
HIGH SCHOOL (S): Career Tech High School
PROGRAM: Computerized Manufacturing and Machining

	GRADE	ENGLISH	MATH	SCIENCE	SOCIAL STUDIES	REQUIRED COURSES RECOMMENDED ELECTIVE COURSES OTHER ELECTIVE COURSES CAREER AND TECHNICAL EDUCATION COURSES			CREDENTIAL CERTIFICATE DIPLOMA DEGREE	SAMPLE OCCUPATIONS
SECONDARY	9	English I	Algebra I	Earth Science	Economics	History and Appreciation of Visual and Performing	*Intro to Technical Occupations	Computer Applications		
	10	English II	Geometry	Biology	U.S. History	BRX 112-Blueprint Reading	MTT 110 Fundamentals of Machine Tools-A	MTT 112 Fundamentals of Machine Tools-B		
	11	English III	Algebra II	Physical Science	World Geography	CAD 100 Intro to CAD	MTT 120 Applied Machining I	MTT 122 Applied Machining II	Machinist Assistant	
	12	English IV	Trigonometry	Chemistry	Health & PE	CMM 130 Manual Programming	CMM 132 CAD/CAM/CNC	MTT 199 Cooperative Education	Certification / TRACK Pre-Apprenticeship /KOSSA/HS	MachineOperator/CNC Program Assisitant
		Take ACT - Apply for admission to Morehead State University					*Courses to be developed			
POSTSECONDARY	Year 13	Writing I & II	Calculus I	Humanities	Computer Competence - IET 110	CAD 200 Intermediate CAD	CMM 2301 Editing and Sub-routines	CMM 2302 Editing and Sub-routines		
	Year 14	Oral Communications CMSP 108	IET 320 Proj Mgt	IET 303 Materials Science	Soc. & Behav. Sci. (Econ 101 or 201)	CAD 240 Advanced Dimension	CAD 250 Advanced CAD	IEX-293 Special Problems	Associate in Applied Science	Manufacturing Supervisor or Technician
	Year 15		Natural and Mathematical Sci. (Phys 201,201A)	IET 330 Industrial Design	Social Sciences (IET 300 Tech.& Society)	ITMT 107 Plastics & 306 Mold Design	IET 319 Quality Control	IET 327 Applied Industrial Management		
	Year 16	IET 499C Senior Project	Math 353 Statistics	IET 422 Industrial Safety Stds.	IET 488 Flexible Manu. Engineering	IET 317 Time and Motion - ITMT 307 Metallurgy	IET 419 Total Quality Imp.	IET 320 Sup. Pract. & ITMT 470 Auto. Mfg. Sys.	Bachelor's Degree	Manufacturing Manager

Required Courses
Recommended Elective Courses
Other Elective Courses
Career and Technical Education Courses
Credit-Based Transition Programs (e.g. Dual/Concurrent Enrollment, Articulated Courses, 2+2+2)
(◆=High School to Comm. College) (● =Com. College to 4-Yr Institution) (■ = Opportunity to test out)
Mandatory Assessments, Advising, and Additional Preparation

Note: Categories of courses (e.g. Required, Recommended Electives, other Electives and career and Technical Education) apply to both secondary and postsecondary levels.

CCTI College and Career Transitions Initiative
Funded by the U. S. Department of Education
(V051B020001)
Revised Jan. 2005
October, 2006-CTE/Kentucky

CAD 250
Advanced CAD
480114

Course Description:
This course is designed to introduce the student to the customization of the CAD software. Menu creation and programming will be applied as it relates to the CAD program.

Prerequisites: Introduction to Computer Aided Drafting -480110

Content/Process

Students will:

1. Demonstrate and practice safe work habits in the lab area.
2. Utilize advanced CAD applications
3. Develop basic programming techniques

Connections

- Common Core Standards
- Common Core Technical Standards
- New Generation Science Standards
- (NIMS) National Institute for Metalworking Skills
- MasterCAM
- Post-Secondary Education
- CTSO's-Skills USA
- KOSSA

CAD 240
Advanced Dimensioning and Measurement
470924

Course Description:
Presents an in-depth study of advanced industrial dimensioning principles, tolerances, fits, and A.N.S.I. standards. Exploration of the shape and geometric characteristics of parts through geometric tolerance.

Prerequisites: Fundamentals of Machine Tool A-470913

Content/Process

Students will:

1. Demonstrate and practice safe work habits in the lab area.
2. Define terms and principles used in advanced dimensioning.
3. Apply using drawing practices, tolerance dimensioning on mating parts.
4. Explain and work with A.N.S.I. standards.
5. Demonstrate surface texture symbols and surface finish.
6. Compare conventional tolerance with Geometric Dimensioning and Tolerance.
7. Establish a basic understanding of Geometric Dimensioning and Tolerance.
8. Analyze specific graphic designs and determine the proper location for dimensions.
9. Define terms and principles relating to Dimensional Metrology.
10. Demonstrate a working knowledge of basic hand held measuring instruments.
11. Measure with basic hand held measuring instruments.
12. Explain the relationship of precision measurement to manufacturing and design.
13. Demonstrate a working understanding of one-tenth of an inch or one-thousandth of an inch.

Connections

- Common Core Standards
- Common Core Technical Standards
- New Generation Science Standards
- (NIMS) National Institute for Metalworking Skills
- MasterCAM
- Post-Secondary Education
- CTSO's-Skills USA
- KOSSA

CMM 120
Applied Machining - I
470911

Course Description:
Consists of intermediate level skills using machining machines and surface grinders. It will include the selection of grinding wheels. Applications in milling, lathe, bench work, and utilizing gauge blocks and the sine bar are covered in this course. Surface grinding and abrasives are introduced and properties of metals are discussed.

Prerequisite: Fundamentals of Machine Tool A-470913
Fundamentals of Machine Tool B-470914

Content/Process

Students will:

1. Machine and finish holes on the milling machine.
2. Cut and finish different type of key seats.
3. Select and use different types of milling cutters.
4. Select and perform basic grinding operation.
5. Machine holes on a vertical mill
6. Form mill on a vertical mill
7. Mill key seats
8. Mill an angle on a vertical mill
9. Cut and finish holes on the milling machine.
10. Demonstrate the care and safe use of machine grinders
11. Select grinding wheels
12. Classify metals and metal shapes.

Connections

- Common Core Standards
- Common Core Technical Standards
- New Generation Science Standards
- (NIMS) National Institute for Metalworking Skills
- MasterCAM
- Post-Secondary Education
- CTSO's-Skills USA
- KOSSA

CMM 122
Applied Machining - II
470912

Course Description:
Carries the student to higher levels in the operation of machine tools. Applications in milling, lathe, bench work, and utilizing gauge blocks and the sine bar are covered in this course. Surface grinding and abrasives are introduced, and properties of metals are discussed.

Prerequisite: Applied Machining I - 470911 or Permission of Instructor

Content/Process

Students will:

1. Perform the grinding of parts with surfaces that are flat, parallel and perpendicular.
2. Perform the machining of tapers on mills and lathes.
3. Perform plunge cutting operations.
4. Perform the knurling on the lathe.
5. Operate a surface grinder
6. Mount, balance, and dress grinding wheels
7. Cut tapers
8. Perform plunge cut operations
9. Chase standard threads on the lathe.
10. Chase metric threads on the lathe.

Connections

- Common Core Standards
- Common Core Technical Standards
- New Generation Science Standards
- (NIMS) National Institute for Metalworking Skills
- MasterCAM
- Post-Secondary Education
- CTSO's-Skills USA
- KOSSA

BRX 110
Basic Blueprint Reading for Machinist
470920

Course Description:
Basic applied math, lines, multi-view drawings, symbols, various schematics and diagrams, dimensioning techniques, sectional views, auxiliary views, threads and fasteners, and sketching typical to all shop drawings are presented. Safety will be emphasized as an integral part of the course.
Prerequisites: None

Content/Process

Students will:

1. Introduction and math review. Demonstrate competency in mathematical fraction and decimal problems.
2. Identify the alphabet of lines
3. Identify multiple views
4. Arrange multiple views
5. Arrange two view drawings
6. Identify one view drawings
7. Arrange and identify auxiliary views
8. Demonstrate the use of size and location dimensions
9. Demonstrate proper dimensions of cylinders and arcs
10. Size dimensions of holes and angles
11. Locate dimensions for centering of holes, points, and centers
12. Interpret the base line dimensions on drawings
13. Calculate tolerances
14. Identify labeling of various screw threads
15. Calculate tapers and machined surfaces
16. Dimension parts using shop notes
17. Identify half, full, and removed sections
18. Interpret ordinate and tabular dimensions
19. Set tolerances using geometric dimensioning techniques
20. Sketch parts with irregular shapes
21. Sketch oblique views of various parts
22. Sketch and dimension shop drawings
23. Identify half, full, and removed sections
24. Identify electrical schematic and diagram symbols
25. Identify welding symbols and equipment
26. Interpret connections and flow of various electrical, hydraulic, and pneumatic schematics and diagrams.

Connections

- Common Core Standards
- Common Core Technical Standards
- New Generation Science Standards
- (NIMS) National Institute for Metalworking Skills
- MasterCAM
- Post-Secondary Education
- CTSO's-Skills USA
- KOSSA

BRX 112
Blueprint Reading for Machinist
470921

Course Description:
Provides the student with a beginning and advanced series of lectures, demonstrations, and practice exercise in the study of prints. Safety will be emphasized as an integral part of this course.

Prerequisites: Consent of Instructor

Content/Process

Students will:

1. Demonstrate competency in mathematical fraction and decimal problems.
2. Identify the alphabet of lines.
3. Identify multiple views.
4. Arrange multiple views.
5. Arrange two view drawings.
6. Identify one view drawings.
7. Arrange and identify auxiliary views.
8. Demonstrate the use of size and location dimensions.
9. Demonstrate proper dimensions of cylinders and arcs.
10. Size dimensions of holes and angles.
11. Locate dimensions for centering of holes, points, and centers.
12. Interpret the base line dimensions on drawings.
13. Calculate tolerances.
14. Identify labeling of various screw threads.
15. Calculate tapers and machined surfaces.
16. Dimension parts using shop notes.
17. Identify half, full, and removed sections.
18. Interpret ordinate and tabular dimensions.
19. Set tolerances using geometric dimensioning techniques.
20. Sketch parts with irregular shapes.
21. Sketch oblique views of various parts.
22. Sketch and dimension shop drawings.
23. Demonstrate visualizing techniques of multiple views.
24. Identify line types used in combinations.
25. Identify standards listings on working drawings.
26. List procedural machining and construction requirements from notations on working drawings.
27. List proper procedure for construction of various machining processes.
28. Determine proper thread series and types for duty specific assembly.
29. Specify duty specific uses of contour notes.
30. Determine overall measurements of contoured parts.

31. Explain various terms involved in multiple sections.
32. Identify usages for chamfers and interpret sizes.
33. Define various chamfer terms.
34. Determine the sizing procedures of necks and grooves.
35. Identify various keyway and key seat standards.
36. Identify usage of geometric symbols.
37. Define terms relating to geometric tolerance.
38. Set standards and tolerances using geometric dimensioning.
39. Set axis coordinates on numerical control prints.
40. Determine axis coordinates on ordinate and tabular prints.
41. Identify casting and forging terms.
42. Calculate bend setbacks in sheet metals and plate steels.
43. Identify parts and materials from various reference books and manuals

Connections

- Common Core Standards
- Common Core Technical Standards
- New Generation Science Standards
- (NIMS) National Institute for Metalworking Skills
- MasterCAM
- Post-Secondary Education
- CTSO's-Skills USA
- KOSSA

CMM 132
CAD/CAM/CNC
470925

Course Description:
This course introduces the student to CAD/CAM/CNC systems which includes CAM software. The student will utilize process planning, manual programming and CAD/CAM for CNC equipment. This student will load a CNC program and set tool and work offsets, and machine part.

Prerequisites: None

Content/Process

Students will:

1. Perform routine maintenance on tools, equipment, and machines
2. Demonstrate knowledge of manual data input on CNC machines
3. Create a roughing tool path for milling applications
4. Enter tool offsets and cutter geometry and work offset
5. Test and run a program
6. Create a thread element, grooving and roughing for turning
7. Use fixed cycles on CNC machines
8. Use an automatic tool changer
9. Work with sub-routines
10. Generate code from converted CAD geometry
11. Use the CAM system to transfer CAD geometry, RS - 232, DNC link
12. Use process planning for CNC equipment.
13. Create drawings on CAM software.
14. Load a CNC program and set tool and work offsets.
15. Generate code using CAM software.
16. Operate CNC equipment.

Connections

- Common Core Standards
- Common Core Technical Standards
- New Generation Science Standards
- (NIMS) National Institute for Metalworking Skills
- MasterCAM
- Post-Secondary Education
- CTSO's-Skills USA
- KOSSA

CMM 199
Cooperative Education I
470929

Course Description: Cooperative Education provides supervised on-the-job work experience related to the student's educational objectives. Students participating in the Cooperative Education program receive compensation for their work.

Prerequisite: Consent of Instructor

Content /Process

Students Will:

1 Demonstrate and practice safe work habits in the lab area.
2 Gain career awareness and the opportunity to test career choice(s)
3 Receive work experience related to career interests prior to graduation
4 Integrate classroom studies with work experience
5 Receive exposure to facilities and equipment unavailable in a classroom setting
6 Increase employability potential after graduation
7 Earn funds to help finance education expenses

Connections:

*Common Core Standards
*KOSSA
*Common Core Technical Standards
*New Generation Science Standards
*AutoDesk Industry Standards
*SolidWorks Industry Standards
*Post-Secondary Education
*CTSO’s-Skills USA

CMM 299
Cooperative Education II
470930

Course Description: Cooperative Education provides supervised on-the-job work experience related to the student's educational objectives. Students participating in the Cooperative Education program receive compensation for their work.

Prerequisite: Consent of Instructor

Content Process

Students Will:

1. Demonstrate and practice safe work habits in the lab area.
2. Gain career awareness and the opportunity to test career choice(s)
3. Receive work experience related to career interests prior to graduation
4. Integrate classroom studies with work experience
5. Receive exposure to facilities and equipment unavailable in a classroom setting
6. Increase employability potential after graduation
7. Earn funds to help finance education expenses
8. Demonstrate and practice safe work habits in the lab area.

Connections:

*Common Core Standards
*KOSSA
*Common Core Technical Standards
*New Generation Science Standards
*AutoDesk Industry Standards
*SolidWorks Industry Standards
*Post-Secondary Education
*CTSO’s-Skills USA

CMM 199 & CMM 299
Cooperative Education III
470931

Course Description:
Cooperative Education provides supervised on-the-job work experience related to the student's educational objectives. Students participating in the Cooperative Education program receive compensation for their work.

Prerequisite: Consent of Instructor

Content Process

Students Will:

1. Demonstrate and practice safe work habits in the lab area.
2. Gain career awareness and the opportunity to test career choice(s)
3. Receive work experience related to career interests prior to graduation
4. Integrate classroom studies with work experience
5. Receive exposure to facilities and equipment unavailable in a classroom setting
6. Increase employability potential after graduation
7. Earn funds to help finance education expenses
8. Demonstrate and practice safe work habits in the lab area.

Connections:

*Common Core Standards
*KOSSA
*Common Core Technical Standards
*New Generation Science Standards
*AutoDesk Industry Standards
*SolidWorks Industry Standards
*Post-Secondary Education
*CTSO's-Skills USA

CMM 2302
Editing and Subroutines (Conversational)
470927

Course Description:
Introduces students to performing editing routines, to subroutines, and to programs that contain loops. Students will also interpret error messages from the control.

Prerequisite: Introduction to Conversational Programming-470926

Content/Process

Students will:

1. General shop safety rules and regulations.
2. Preventative measures.
3. Hazardous materials.
4. Safe use of CNC milling machines.
5. Use conversational programming of CNC machine tools.
6. Complete projects using the skills obtained in the classroom in work situations.
7. Write a conversational program.
8. Troubleshoot the program and correct mistakes.
9. Identification of errors and correction of them in programs.
10. Improvement of programs.
11. Writing programs by hand.
12. Performance of machining operations using programs written by hand.
13. Editing of existing programs.
14. Edit existing blocks in programs.
15. Interpret error messages from the control.
16. Demonstrate knowledge of when to use and when not to use polar coordinates.
17. Calculate X, Y or Z and I, J, or K points using the Pythagorean Theorem and trigonometry.
18. Write a program containing subroutines.
19. Write a program containing loops.

Connections

- Common Core Standards
- Common Core Technical Standards
- New Generation Science Standards
- (NIMS) National Institute for Metalworking Skills
- MasterCAM
- Post-Secondary Education
- CTSO's-Skills USA
- KOSSA

CMM 110
Fundamentals of Machine Tools - A
470913

Course Description:
This course provides the basic principles needed for a solid foundation in machine tool technology. Areas and machines covered include shop safety, bench work, drill press, power saw, measurement, mills, and lathes.

Prerequisites: None

Content/Process

Students will:

1. Demonstrate and practice safe work habits in the lab area. As outlined in NIMS Framework for Machining Skills.
2. Perform bench work processes, hacksaw, files, layout, drill, tap and other activities to meet industry standards.
3. Perform safe and functional activities on the following machines: horizontal bandsaw, vertical band saw, drill press, arbor press, lathes, and mills.
4. Perform tasks with cutting hand tools and non-cutting hand tools.
5. Identify and explain the handling procedure for hazardous material and the content of MSDS.
6. Identify safety needs and regulations in a machine shop.
7. Identify non-cutting hand tools and the proper use of them.
8. Prepare for a bench work process
9. Hand saw with a hacksaw
10. Bench file the work piece
11. Dress and true grinding wheels on bench and pedestal grinders
12. Demonstrate knowledge of power saws, parts, and applications
13. Demonstrate the care and safe use of the power saw
14. Cut and weld band saw blades
15. Perform operations on the cut-off saw
16. Perform operations on the vertical band saw
17. Demonstrate knowledge of drill press, parts, and applications
18. Demonstrate the care and safe use of the drill press
19. Calculate and set the cutting speed and feed on the drill press
20. Sharpen drills
21. Set up a drill press and drill holes
22. Shape and finish holes on a drill press
23. Tap holes by hand and machine on a drill press

24. Thread by hand with taps and dies
25. Operate an arbor press
26. Use chisels and punches
27. Demonstrate knowledge of hazardous materials handling
28. Demonstrate knowledge of hazardous materials storage
29. Demonstrate lock-out/tag-out procedures
30. Demonstrate use of MSDS
31. Measure with basic hand held measuring instrument.

Connections

- Common Core Standards
- Common Core Technical Standards
- New Generation Science Standards
- (NIMS) National Institute for Metalworking Skills
- MasterCAM
- Post-Secondary Education
- CTSO's-Skills USA
- KOSSA

CMM 112
Fundamentals of Machine Tools - B
470914

Course Description:
This course provides intermediate skill development in machine tool technology. The course builds on basic skills developed in MTT 110, especially in the calculation of safe cutting speed and feed rates for the drill press, power saw, mills, and lathes. Shop safety, bench work, and precision measurement are also emphasized.

Prerequisites: None

Content/Process

Students will:

1. Demonstrate and practice safe work habits in the lab area.
2. Demonstrate knowledge of lathes, parts, and applications
3. Demonstrate the care and safe use of lathes
4. Demonstrate use and knowledge of mill parts and applications.
5. Demonstrate knowledge of cutting tools.
6. Demonstrate knowledge of cutting fluids.
7. Identify and explain the handling procedure for hazardous material and the content of MSDS.
8. Calculate and set speeds and feeds on a lathe
9. Sharpen high speed tool bits
10. Mount work piece on a lathe
11. Face a work piece
12. Perform turning operations
13. Machine with carbide cutting tools
14. File and polish a work piece
15. Demonstrate knowledge of a milling machine, parts, and applications
16. Demonstrate the care and safe use of milling machines
17. Calculate and set speeds and feeds on the milling machine
18. Mill flat surfaces and grooves using a vertical mill
19. Apply cutting fluid to machining operations

Connections

- Common Core Standards
- Common Core Technical Standards
- New Generation Science Standards
- (NIMS) National Institute for Metalworking Skills
- MasterCAM
- Post-Secondary Education
- CTSO's-Skills USA

- KOSSA

CMM 198
Internship (CMM)
470932

Course Description:
Internship provides supervised on-the-job work experience related to the student's educational objectives. Students participating in the Internship do not receive compensation.

Prerequisites: Permission of the Instructor

Content /Process

Students Will:

1. Gain career awareness and the opportunity to test career choice(s)
2. Receive work experience related to career interests prior to graduation
3. Integrate classroom studies with work experience
4. Receive exposure to facilities and equipment unavailable in a classroom setting
5. Increase employability potential after graduation

Connections:

*Common Core Standards
*KOSSA
*Common Core Technical Standards
*New Generation Science Standards
*NCCER Industry certifications
*Post-Secondary Education
*CTSO's-Skills USA

CAD 200
Intermediate Computer Aided Drafting
480112

Course Description:
Uses CAD software to produce advanced two-and three-dimensional object drawings. Advanced techniques of drafting, layering, and symbols associated with one or more design applications. Calculations of perimeters, areas, and mass associated with the drawings. (PROJECT LEAD THE WAY COMPONENT)

Intro to Computer Aided Drafting-480110

Content /Process

Students Will:

1. Demonstrate and practice safe work habits in the lab area.
2. Demonstrate, through practice and communications, a comprehensive working knowledge of CAD drafting and the drafting symbols associated with one or more design applications.
3. Produce complex drawings through use of CAD techniques.
4. Use CAD to calculate perimeters and areas for design features.
5. Construct three-dimensional models using various techniques.
6. Project two-dimensional orthographic and axonometric views and sections off of the three-dimensional models.
7. Use advanced CAD operations.

Connections:

*Common Core Standards
*KOSSA
*Common Core Technical Standards
*New Generation Science Standards
*NCCER Industry certifications
*Post-Secondary Education
*CTSO's-Skills USA

CAD 100
Intro to Computer Aided Drafting
480110

Course Description: Uses computer graphic workstation in the application of fundamental principles and capabilities of CAD, basic drafting conventions, and operations. An in-depth study of computer aided drafting commands, terminology, command utilization, and skill development.

Content Process

Students Will:

1. Demonstrate and practice safe work habits in the lab area.
2. Describe, using correct computer terminology, basic computer functions, uses of computers in society and different types of software.
3. Discuss ethical computing issues, such as copyright, privacy, security, and property.
4. Use graphical user interface.
5. Use computer application programs.
6. Access information sources found on networks such as the Internet and be familiar with Web browsers, search sources, and sources of information related to his or her own field.
7. Demonstrate an awareness of different types of software applications.
8. Produce line entities using various coordinate techniques.
9. Construct geometric shapes in two-dimensional space.
10. Develop detailed orthographic views as required.
11. Construct cross sections of various designs, with cross-hatching incorporated as desired.
12. Apply dimensions and annotations to drawings.
13. Move, copy, delete, and save drawings or portions of drawings.
14. Use CAD to manipulate drawings by means of translation, rotation, scaling, zooming, panning, and windowing.
15. Explore 3-D drawing techniques.

Connections:

*Common Core Standards
*KOSSA
*Common Core Technical Standards
*New Generation Science Standards
*NCCER Industry certifications
*Post-Secondary Education
*CTSO's-Skills USA

CMM 2301
Introduction to Conversational Programming
470926

Course Description:
Introduce students to conversational programming guidelines, which will include program preparation, conversational input, and minor editing.

Prerequisites: Fundamentals of Machine Tools - A 470913
Fundamentals of Machine Tools - B 470914

Content/Process

Students will:

1. General shop safety rules and regulations.
2. Preventative measures.
3. Hazardous materials.
4. Safe use of CNC milling machines.
5. Use conversational programming of CNC machine tools.
6. Complete projects using the skills obtained in the classroom in work situations.
7. Write a conversational program.
8. Troubleshoot the program and correct mistakes.
9. Response to prompts.
10. Preparation of a conversational program.
11. Edit of existing conversational programs.
12. Performance of machining operations using programs created by student.
13. Respond to prompts correctly to build a program.
14. Prepare a program in conversational language.
15. Compare conversational input to coded input.
16. Determine errors in programs and correct them.
17. Look for improvements in the process of a program.
18. Insert blocks of information into programs.
19. Delete blocks of information from programs

Connections

- Common Core Standards
- Common Core Technical Standards
- New Generation Science Standards
- (NIMS) National Institute for Metalworking Skills
- MasterCAM
- Post-Secondary Education
- CTSO's-Skills USA
- KOSSA

CMM 130
Manual Programming
470915

Course Description:
This course introduces the student to CNC format and the Cartesian Coordinate System. It also introduces the student to CNC codes and programming, set-up and operation of CNC machine tools. The student will utilize process planning and manual programming for CNC equipment. The student will load a CNC program and set tool and work offsets.

Prerequisites: None

Content/Process

Students will:

1. Use process planning for CNC equipment.
2. Use manual programming for CNC equipment.
3. Load a CNC program and set tool and work offsets.
4. Identify the tasks that must be done to put a job into production.
5. Use proper tool path sequencing.
6. Apply the "Rule of Thumb" to determine rotary axis direction and the "Right-Hand Rule".
7. Describe the characteristics and differences between position and reference points.
8. Calculate coordinate points using absolute Cartesian values.
9. Calculate coordinate points using incremental Cartesian values.
10. Identify basic CNC code structure.

Connections

- Common Core Standards
- Common Core Technical Standards
- New Generation Science Standards
- (NIMS) National Institute for Metalworking Skills
- MasterCAM
- Post-Secondary Education
- CTSO's-Skills USA
- KOSSA

BRX 210
Mechanical Blueprint Reading
470922

Course Description:
Provides the student with an advanced series of lectures, demonstrations, and practice exercises in the study of prints involving math (both decimal and metric), combination of lines, multi-view drawings, assembly drawings, fasteners, machining and construction processes, datum coordinates, numerical control prints, sheet metal prints, welding, casting and forging prints. Safety will be emphasized.

Prerequisite: Basic Blueprint Reading for Machinists-470920

Content/Process

Students will:

1. Demonstrate visualizing techniques of multiple views.
2. Identify line types used in combinations.
3. Identify standards listings on working drawings.
4. List procedural machining and construction requirements from notations on working drawings.
5. List proper procedure for construction of various machining processes.
6. Determine proper thread series and types for duty specific assembly.
7. Specify duty specific uses of contour notes.
8. Determine overall measurements of contoured parts.
9. Explain various terms involved in multiple sections.
10. Identify usages for chamfers and interpret sizes.
11. Define various chamfer terms.
12. Determine the sizing procedures of necks and grooves.
13. Identify various keyway and key seat standards.
14. Identify usage of geometric symbols.
15. Define terms relating to geometric tolerance.
16. Set standards and tolerances using geometric dimensioning.
17. Set axis coordinates on numerical control prints.
18. Determine axis coordinates on ordinate and tabular prints.
19. Identify casting and forging terms.
20. Calculate bend setbacks in sheet metals and plate steels.
21. Identify parts and materials from various reference books and manuals.

Connections

- Common Core Standards
- Common Core Technical Standards
- New Generation Science Standards
- (NIMS) National Institute for Metalworking Skills
- MasterCAM
- Post-Secondary Education

- CTSO's-Skills USA
- KOSSA

CMM 118
Metrology/Control Charts
470928

Course Description:
Provides the basic principles in using precision measurement instruments and their application to inspection and quality control.

Prerequisite: None

Content/Process

Students will:

1. Demonstrate and practice correct use of gauging equipment.
2. Demonstrate use of gauging equipment in part inspection.
3. Demonstrate knowledge of common control chart information.
4. Use gauging equipment to supply control charts with chart information.
5. Discuss Coordinate Measuring Machine.
6. Demonstrate and practice correct use of optical comparator.
7. Demonstrate knowledge, skills and abilities of applied Statistics as outlined in the NIMS Framework for Machining Skills. Identify parts and materials from various reference books and manuals.

Connections

- Common Core Standards
- Common Core Technical Standards
- New Generation Science Standards
- (NIMS) National Institute for Metalworking Skills
- MasterCAM
- Post-Secondary Education
- CTSO's-Skills USA
- KOSSA

IEX 293
Special Problems
470979

Course Description:
This is a course designed for the student who has demonstrated specific needs.
Prerequisites:

Permission of Instructor

Content/Process

Students will:

1. Selected tasks/problems as determined by the instructor.

Connections

- Common Core Standards
- Common Core Technical Standards
- New Generation Science Standards
- (NIMS) National Institute for Metalworking Skills
- MasterCAM
- Post-Secondary Education
- CTSO's-Skills USA
- KOSSA

MAT 116
Technical Mathematics
270643

Course Description:
Concepts that will allow student to become proficient in the mathematics used in technical fields are the focal point of this course. Topics include manipulations of whole numbers, integers, fractions and decimals; measurement systems; an introduction to simple geometric figures; algebraic expressions; linear and quadratic equations; and solving right and oblique triangles using fundamentals of trigonometry.

Prerequisites: Permission of Instructor

Content/Process

Students will:
1. Perform conversions using U. S. customary and SI (metric) measures.
2. Apply basic plane geometric principles of lines, angles, triangles and other polygons, circles and arcs, congruency and similarity.
3. Calculate surface area and volume of basic geometric solids.
4. Solve problems involving significant digits and accuracy and precision of numbers.
5. Solve problems involving ratio, proportion, direct, inverse and joint variation.
6. Perform conversions between coordinate systems.
7. Apply fundamentals of trigonometric functions and co-functions to right triangles.
8. Apply the law of sines and the law of cosines to oblique triangles.
9. Solve problems involving compound angles.
10. Identify the vector concept, the components of vectors and add vectors.
11. Use a scientific calculator.
12. Problem solving involving the above competencies.

Connections
- Common Core Standards
- Common Core Technical Standards
- New Generation Science Standards
- (NIMS) National Institute for Metalworking Skills
- MasterCAM
- Post-Secondary Education
- CTSO's-Skills USA
- KOSSA

DLC 100
Digital Literacy
060112

Course Description:
The impact of computers on society, and ethical issues are presented. Students use microcomputer and application software, including word processing, database, spreadsheets, presentation software, and the Internet, to prepare elementary documents, reports, and electronic presentations.

Prerequisites: Permission of Instructor

Content/Process

Students will:

1	Use a word processing program to create, save, print, modify, spell-check, and grammar-check a simple document
2	Use a word processing program to enhance the appearance of a simple document by using centered, right-justified, boldfaced, underlined, and italicized text
3	Use a word processing program to change the default margins and line spacing
4	Use a word processing program to create a document with headers, footers, and footnotes
5	Use an electronic spreadsheet to create, save, print, modify, and obtain graphs from a simple spreadsheet.
6	Use an electronic spreadsheet to perform basic mathematical operations including, but not limited to addition, subtraction, multiplication, and division
7	Use an electronic spreadsheet to calculate averages and percent's
8	Use an electronic spreadsheet program to enhance the appearance of a spreadsheet by changing fonts, foreground and background colors; and centering text across columns
9	Use a database management program to create, maintain, and print reports from a simple relational database
10	Use a database management program to customize the user interface by creating and maintaining forms and reports
11	Use a database management program to query tables using basic query operations such as "and", "or", "not", etc.
12	Print in landscape and portrait orientations
13	Use the component of the operating system that helps the user manipulate files and folders to copy, move, rename, and delete files; and to create, copy, move, rename, and delete folders
14	Use a World Wide Web browser to navigate hypertext documents and to download files
15	Use Internet search engines and understand their advantages and disadvantages
16	Use an electronic mail program to send and receive electronic mail
17	Discriminate between ethical and unethical uses of computers and information including e-mail and

	internet etiquette
18	Demonstrate a basic understanding of issues regarding software copyright, software licensing, and software copying
19	Demonstrate an awareness of computer viruses and a basic understanding of ways to protect a computer from viruses
20	Demonstrate a basic understanding of the impact of computers on society
21	Use and understand basic computer terminology
22	Identify types of computers, how they process information and how individual computers interact with other computing systems and devices
23	Identify the function of computer hardware components
24	Identify the factors that go into an individual or organizational decision on how to purchase computer equipment
25	Identify how to maintain computer equipment and solve common problems relating to computer hardware
26	Identify how software and hardware work together to perform computing tasks and how software is developed and upgraded
27	Identify different types of software, general concepts relating to software categories, and the tasks to which each type of software is most suited or not suited
28	Identify what an operating system is and how it works, and solve common problems related to operating systems
29	Manipulate and control the Windows desktop, files, and disks
30	Identify how to change system settings, install and remove software
31	Be able to start and exit a Windows application and utilize sources of online help
32	Identify common on-screen elements of Windows applications, change application settings and manage files within an application
33	Describe and implement the protocol of utilizing presentation software.
34	Use a presentation program to create, save, modify, spell check, and grammar-check a simple presentation.
35	Deleted Task
36	Use a presentation program to enhance the appearance of the slide designs, background colors, and layout.
37	Utilize the print features in a presentation to include handouts, speaker's notes, and black and white.

Connections

- Common Core Standards
- Common Core Technical Standards
- New Generation Science Standards
- (NIMS) National Institute for Metalworking Skills
- MasterCAM
- Post-Secondary Education

- CTSO’s-Skills USA
- KOSSA